

2022 Caspian Lake Water Quality Monitoring Results: Lay Monitoring Program and LaRosa Partnership Program

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VT Department of Environmental Conservation, UVM Lake Champlain Sea Grant



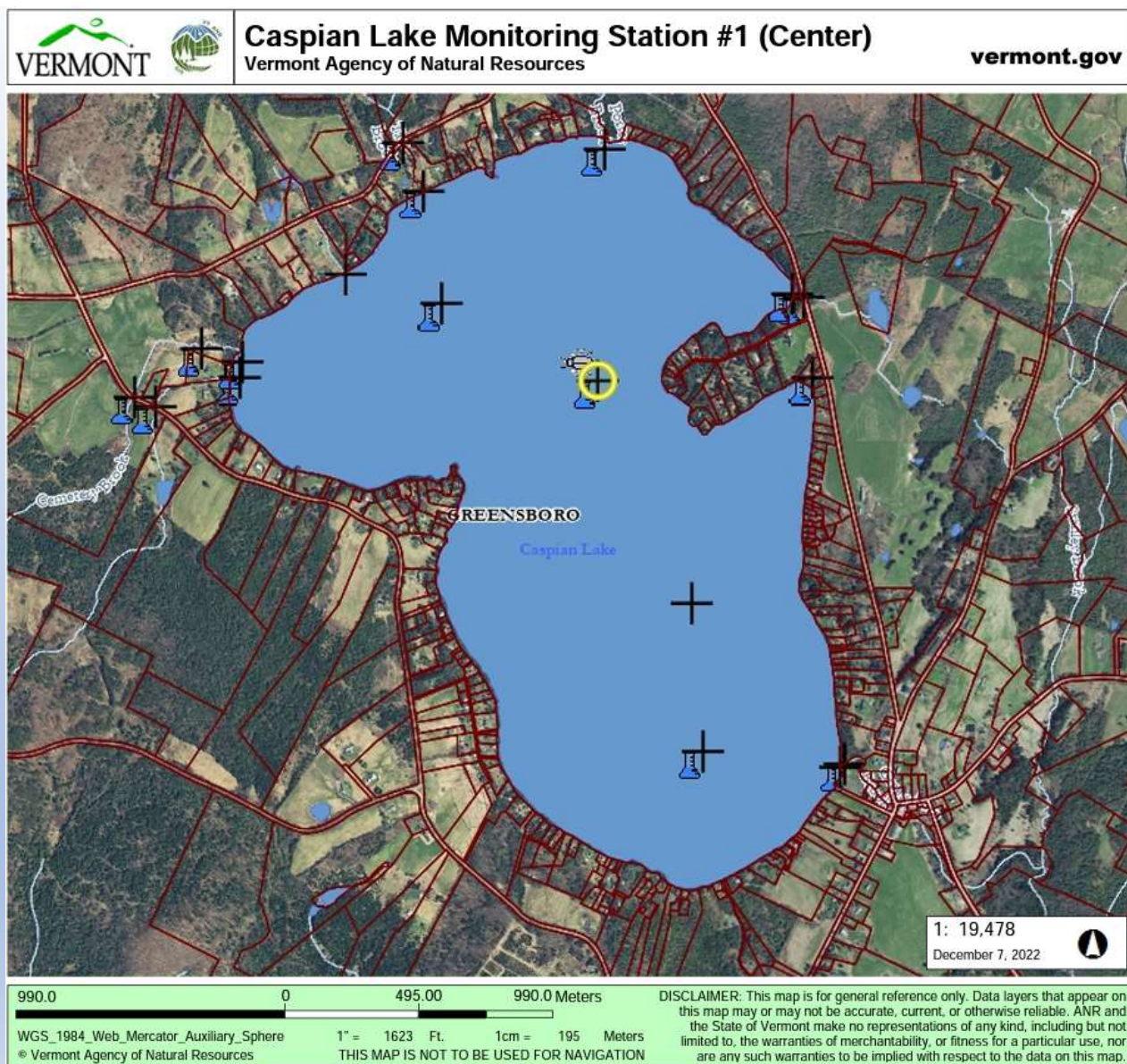
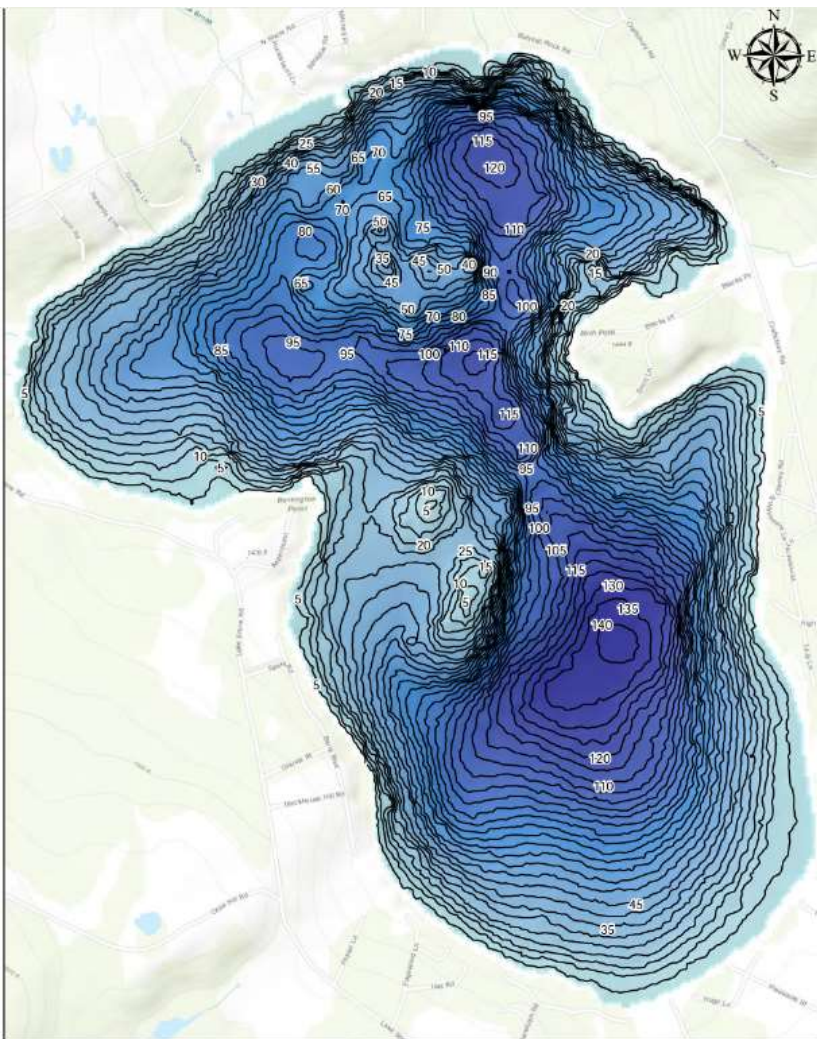


Lay Monitoring Program (LMP) Lake Sampling Overview

- Weekly from Memorial Day to Labor Day (minimum of 8 samples for summer mean):
 - *Basic Sampling*: Measure Secchi disk transparency depth (clarity)
 - *Supplemental Sampling*: Collect water samples that are lab tested for total phosphorus (nutrient) concentration and chlorophyll-a (algae) concentration
 - Complete a lake sampling webform (and report cyanobacteria conditions)



<https://dec.vermont.gov/watershed/lakes-ponds/monitor/lay-monitoring>



Vermont Lake Score Card

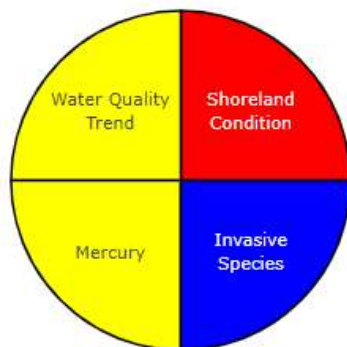
Caspian Lake

<https://dec.vermont.gov/watershed/lakes-ponds/data-maps/scorecard>

Scores

Water Quality Data

Lake Information



Watershed: **Highly Disturbed**

WQ Standards: **Stressed**

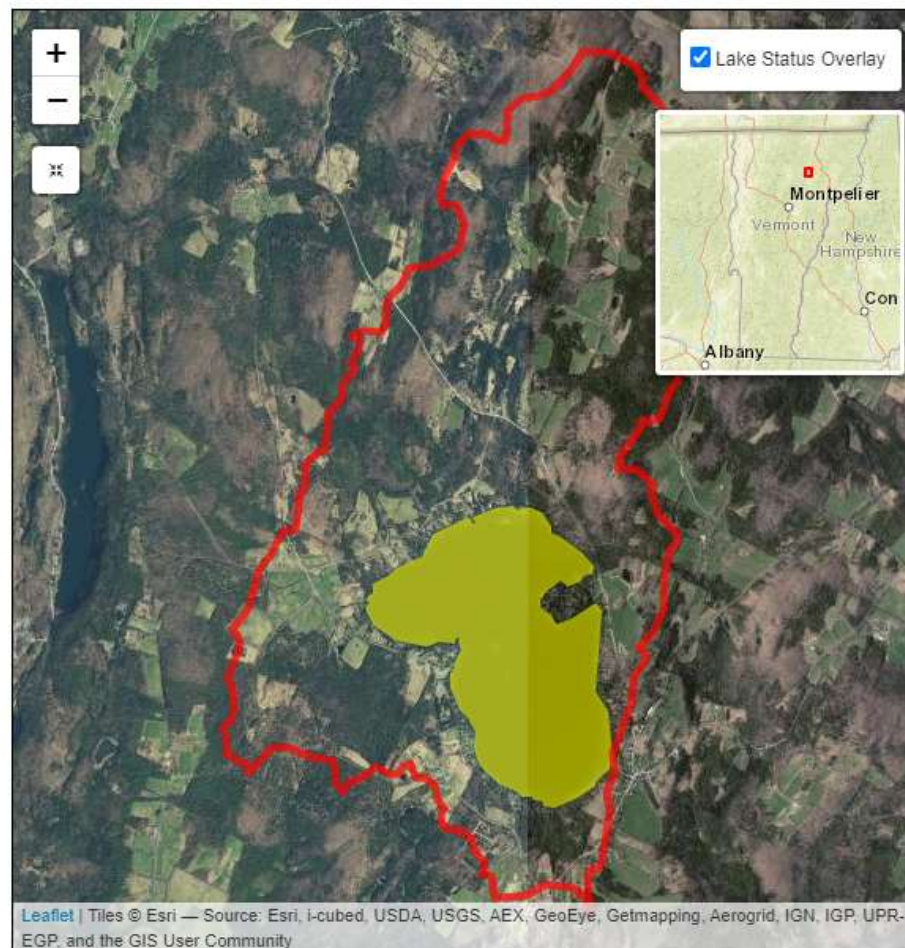
Details

Stressed – Flow alteration

Color Scoring System

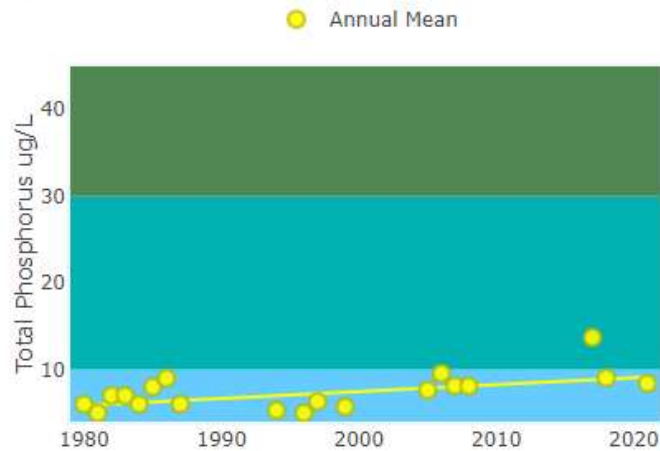
- Good Conditions
- Fair Conditions
- Poor Conditions
- Insufficient Data

[Learn How Lakes Are Scored](#)



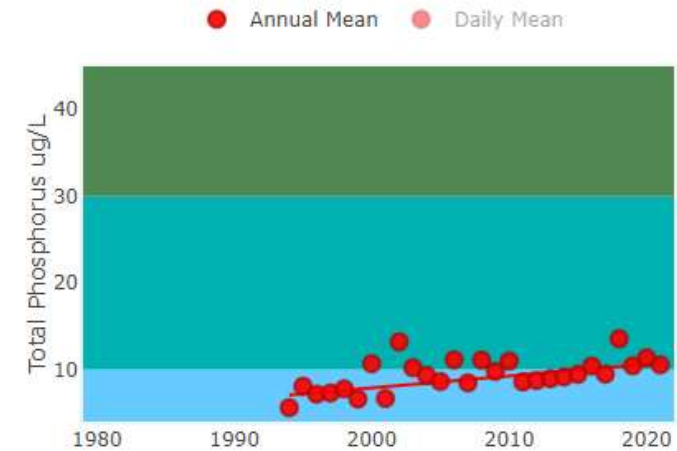
Spring Phosphorus

Trend: Significantly Increasing (p-value=0.0115)



Summer Phosphorus

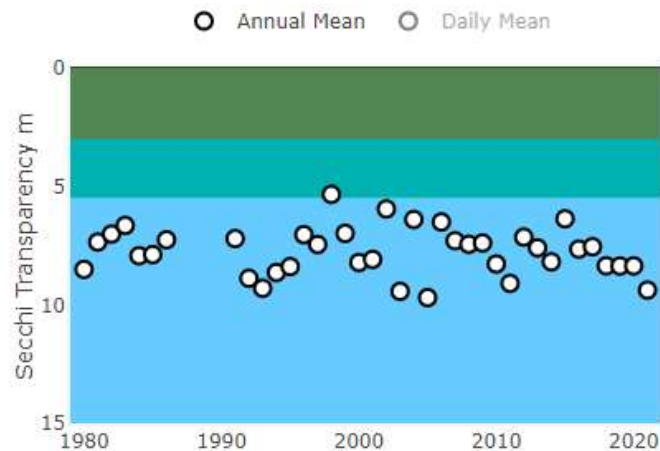
Trend: Highly Significantly Increasing (p-value=0.001)



CASPIAN LAKE SCORE CARD WATER QUALITY TRENDS

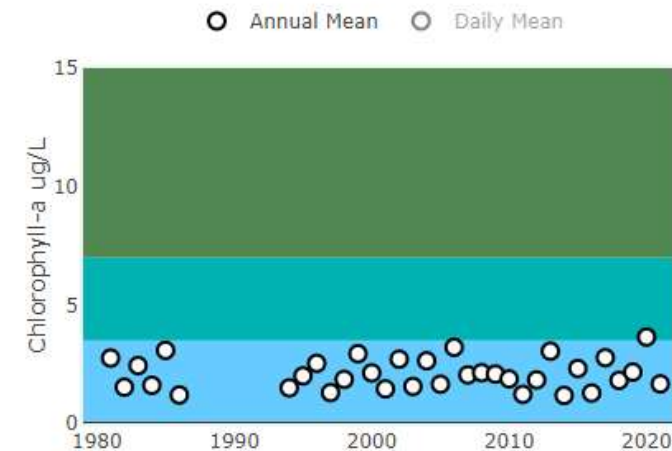
Summer Secchi

Trend: Stable (p-value=0.2967)



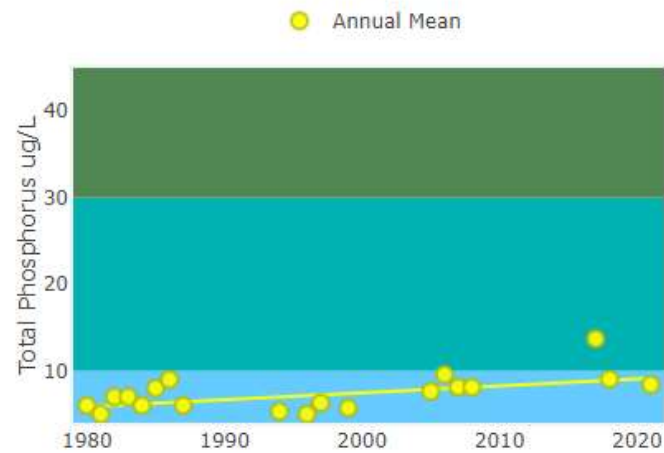
Summer Chlorophyll-a

Trend: Stable (p-value=0.7782)



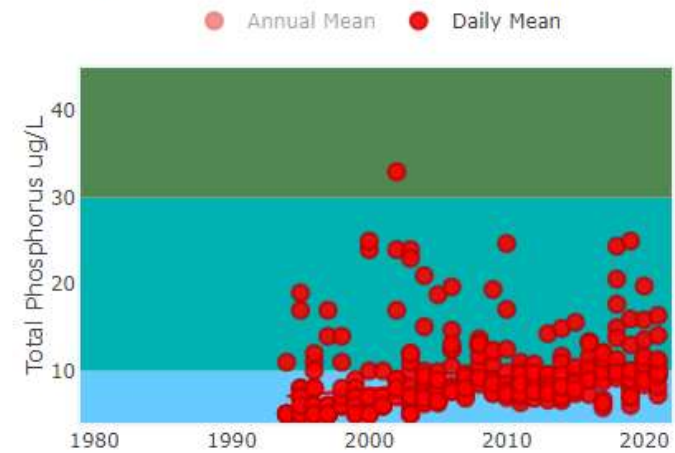
Spring Phosphorus

Trend: Significantly Increasing (p-value=0.0115)



Summer Phosphorus

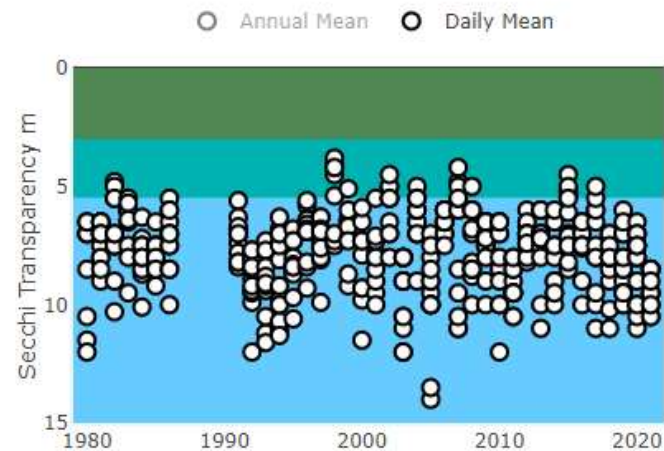
Trend: Highly Significantly Increasing (p-value=0.001)



CASPIAN LAKE SCORE CARD WATER QUALITY TRENDS

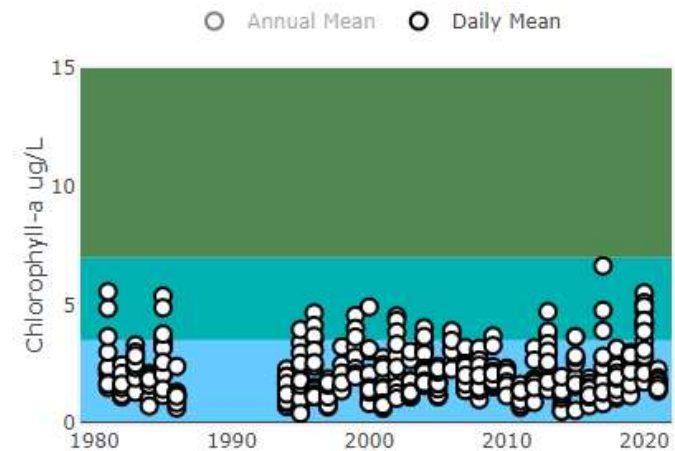
Summer Secchi

Trend: Stable (p-value=0.2967)

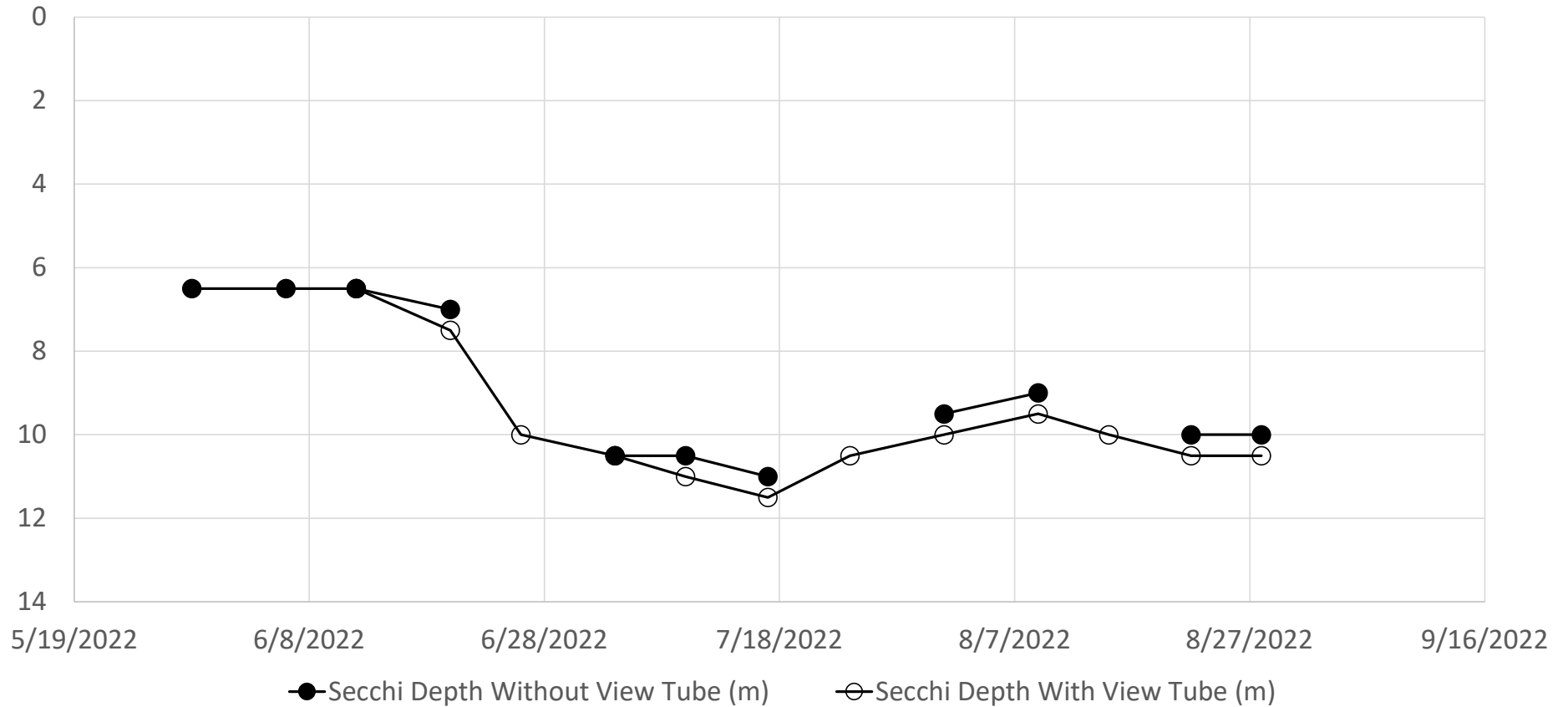


Summer Chlorophyll-a

Trend: Stable (p-value=0.7782)

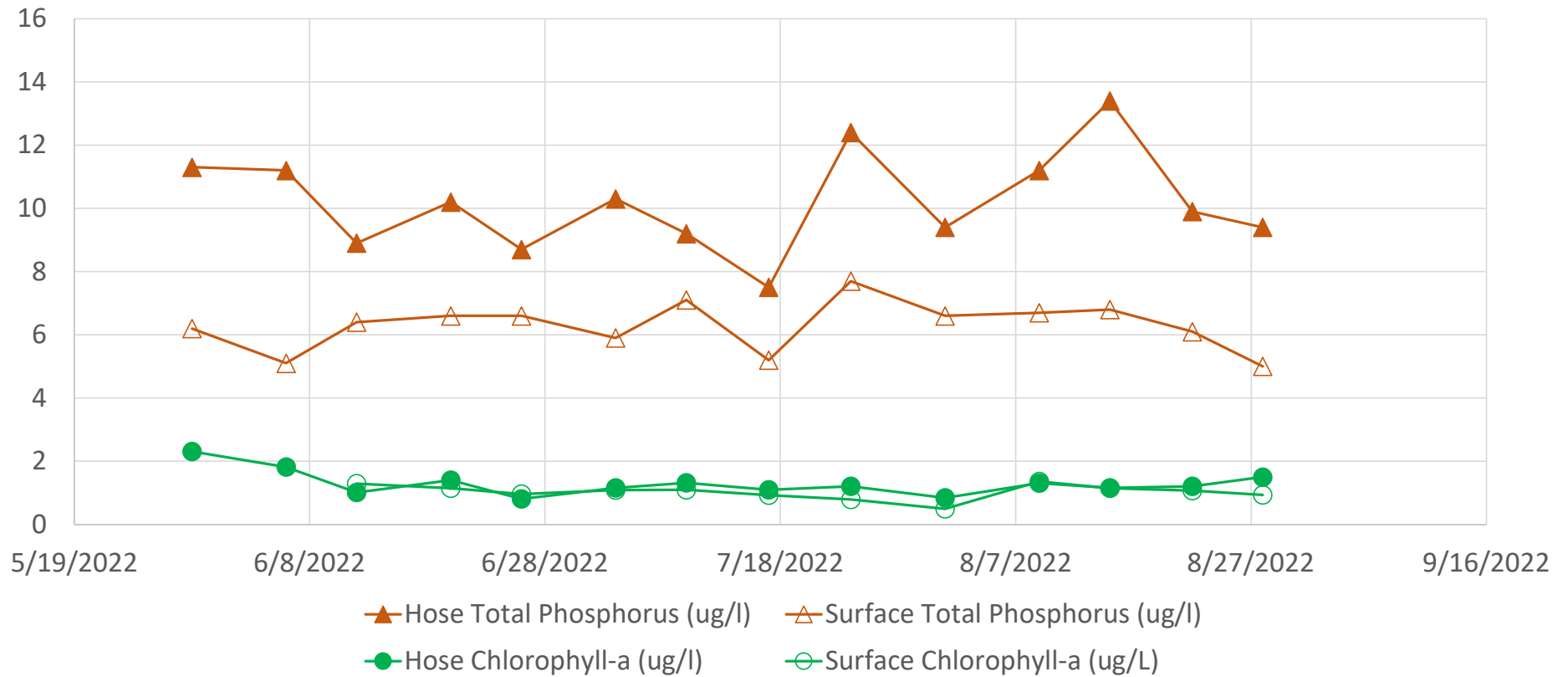


2022 Caspian Lake Lay Monitoring Secchi Depth Results

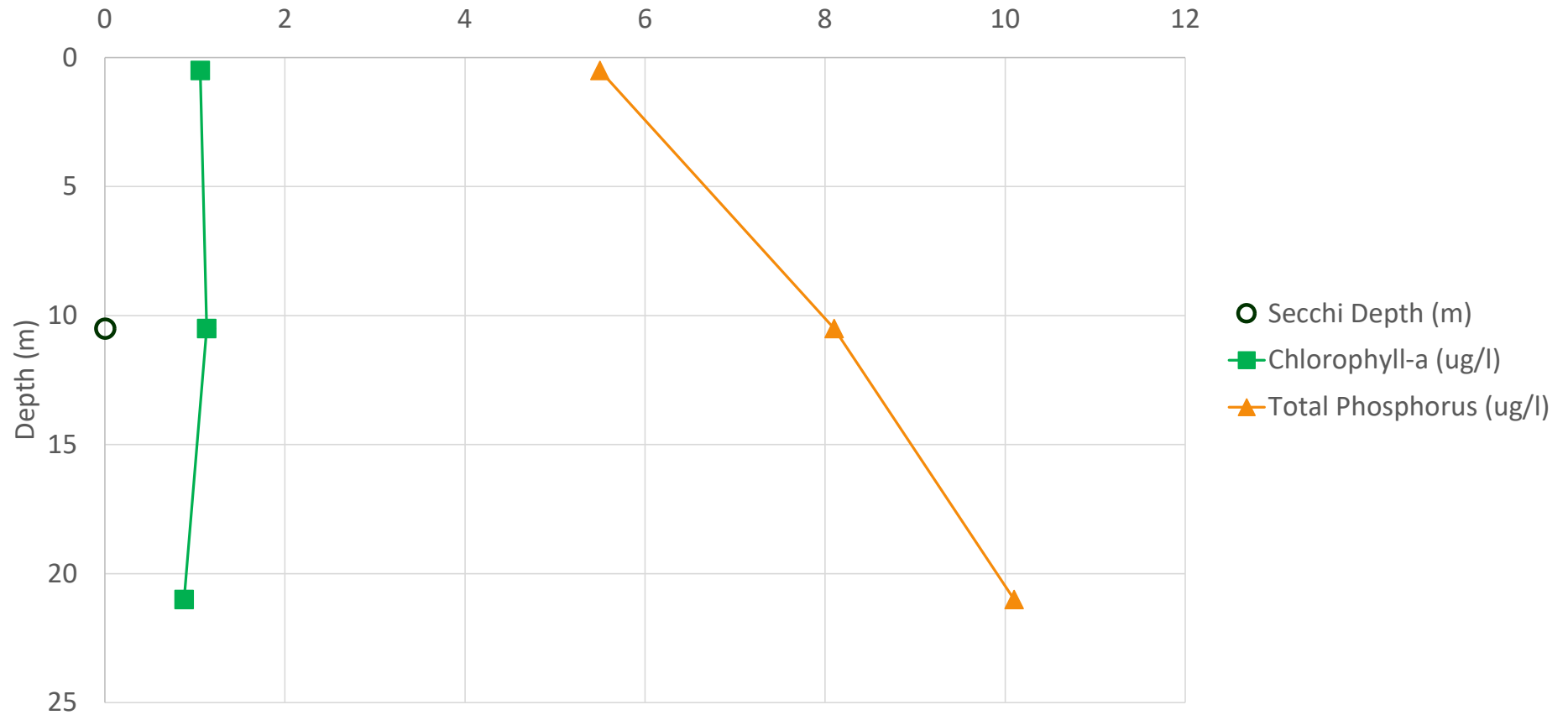


2022 Caspian Lake Lay Monitoring Total Phosphorus and Chlorophyll-a Results

(Note: Hose Integrated Sample Depth = 2X Secchi Depth)



Caspian Lake Water Quality Vertical Profile 9/2/2022



DATE	HOSE SAMPLE DEPTH (M)	HOSE TOTAL PHOSPHORUS (UG/L)	SURFACE TOTAL PHOSPHORUS (UG/L)	HOSE CHLOROPHYLL-A (UG/L)	SURFACE CHLOROPHYLL-A (UG/L)	SECCHI DEPTH WITHOUT VIEW TUBE (M)	SECCHI DEPTH WITH VIEW TUBE (M)
5/29/2022	13	11.3	6.2	2.31		6.5	
6/6/2022	13	11.2	5.1	1.82		6.5	
6/12/2022	13	8.9	6.4	1.01	1.29	6.5	6.5
6/20/2022	15	10.2	6.6	1.4	1.15	7	7.5
6/26/2022	20	8.7	6.6	0.81	0.96		10
7/4/2022	21	10.3	5.9	1.16	1.09	10.5	10.5
7/10/2022	21	9.2	7.1	1.32	1.1	10.5	11
7/17/2022	20	7.5	5.2	1.1	0.93	11	11.5
7/24/2022	21	12.4	7.7	1.21	0.79		10.5
8/1/2022	20	9.4	6.6	0.84	0.5	9.5	10
8/9/2022	19	11.2	6.7	1.31	1.36	9	9.5
8/15/2022	20	13.4	6.8	1.16	1.15		10
8/22/2022	20	9.9	6.1	1.21	1.07	10	10.5
8/28/2022	21	9.4	5	1.5	0.94	10	10.5
Mean	18.4	10.2	6.3	1.30	1.03	8.8	9.8
A1 Criteria	Euphotic Zone	12	12	2.6	2.6	5.0	5.0



LaRosa Partnership Program (LPP) Tributary Sampling Overview

- Tributaries first sampled by LMP 2019-2020
- Since 2021, sampled by LPP ~biweekly from April/May to September + storm events
- 763C.buryRd (Trib 10)
 - Highest TP recorded in past years
- C.bury-Blacks PT (Trib 6)
 - Occasionally high TP events in past years
- Porter-S Bridge
 - Greatest volume of tributary flow into Caspian Lake
- Tate-NShoreRd
 - 2nd greatest volume of tributary flow into Caspian Lake
- Cem-LShoreRd
 - Occasionally high TP events in past years

LPP Sample Parameters Overview: Total Phosphorus & Chloride

Total Phosphorus

- Sources
 - Developed land runoff, roads, driveways
 - Fertilizers – lawns and agriculture
- Impacts
 - Feeds plants, algae and cyanobacteria
 - Aesthetics, Recreation, Aquatic Life Uses
- Vermont Water Quality Standards Nutrient Criteria for Aquatic Biota Use (+ Biological Criteria)
 - Not to be exceeded at low median monthly flow (baseflow) during June through October
 - 12 ug/L for small high gradient streams (SHG)
 - 15 ug/L for medium high gradient streams (MHG)
 - 27 ug/L for warm-water medium gradient streams and rivers (WWMG)

Total Chloride

- Sources
 - Road salt
 - Wastewater, water softeners
- Impacts
 - Affects chemical processes of biological organisms
 - Aquatic Life Use
- Vermont Water Quality Standards Chloride Criteria for Aquatic Biota Use
 - 860 mg/L maximum (acute)
 - 230 mg/L average (chronic)
 - Studies show chloride can impact organisms at lower concentrations

Chemical Parameters – Nitrogen

Total Nitrogen

- Impacts
 - Can fuel specific types of cyanobacteria blooms
 - Too much nitrogen, as nitrate, in drinking water can be harmful to young infants or young livestock.
- Sources
 - Fertilizers – lawn and ag
 - Sewage
- Vermont Water Quality Standards
 - Not to exceed 5.0 mg/l as NO₃-N at flows exceeding low median monthly flows, in Class B(1) and B(2) waters.
 - Not to exceed 2.0 mg/l as NO₃-N at flows exceeding low median monthly flows, in Class A(1) and A(2) waters at or below 2,500 feet altitude, National Geodetic Vertical Datum.

Parameters Monitored in 2022

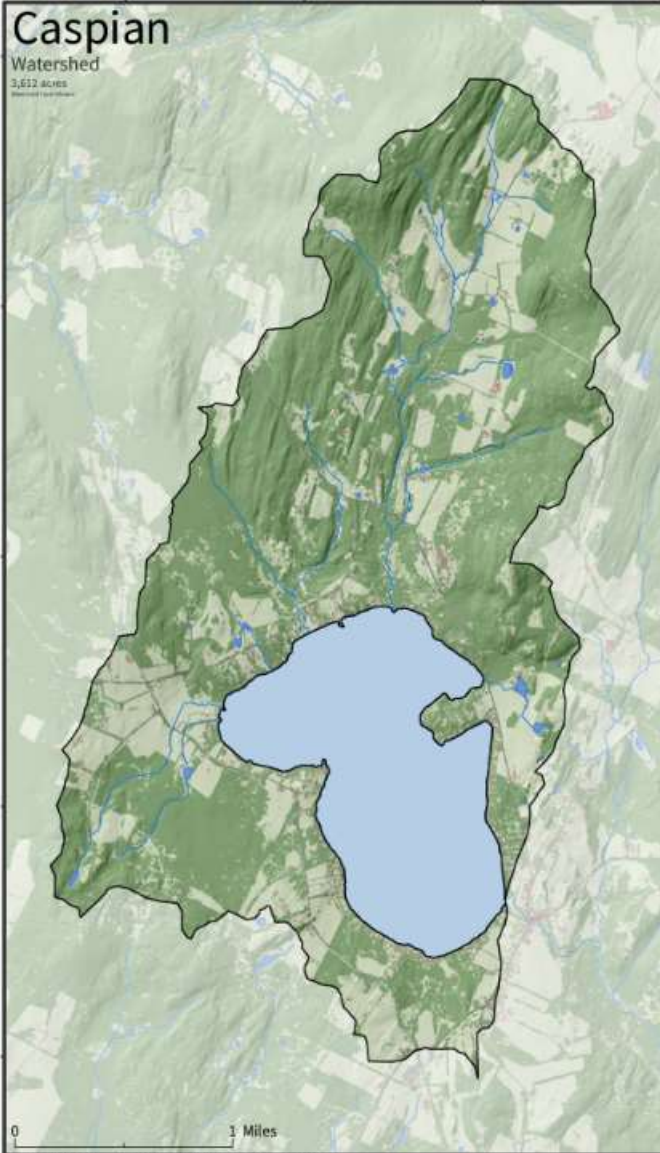
- Porter Brook
 - TP, TN, Chloride
- Tate Brook
 - TP
- Cemetery Brook 2
 - TP
- Trib 6
 - TP, TN, Chloride
- Trib 10
 - TP, TN

Caspian

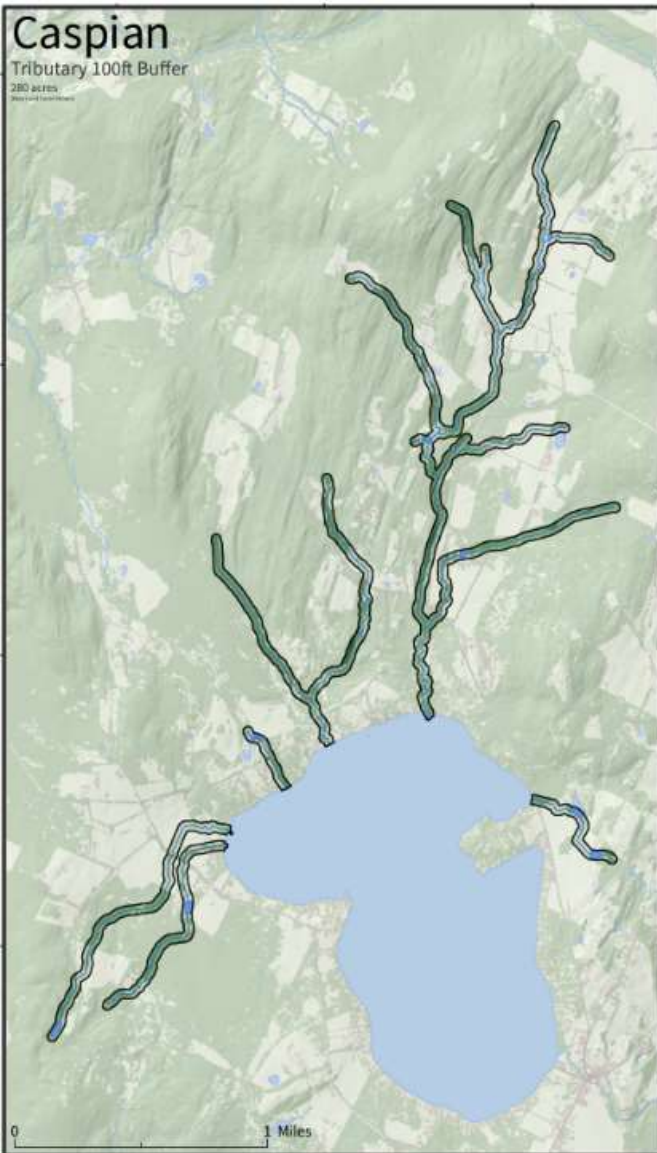
Watershed

3,612 ACRES

Revised 1/20/2018

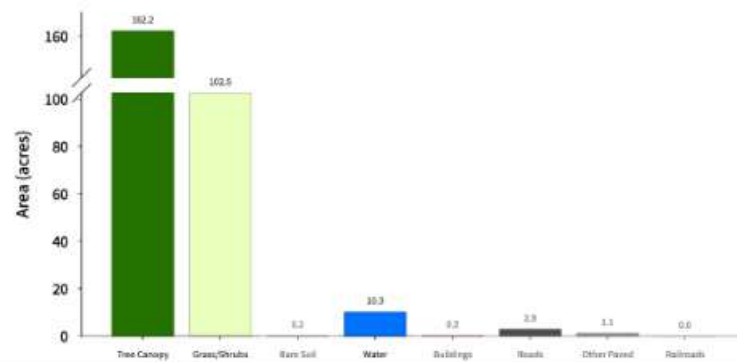


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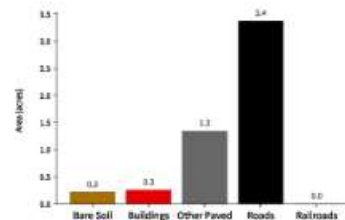
High-Resolution Land Cover Summary

Base Land Cover (Top-Down*)

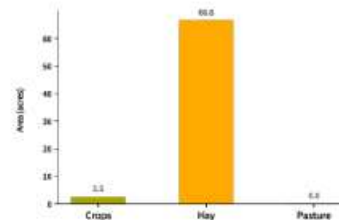


Supplemental Land Cover

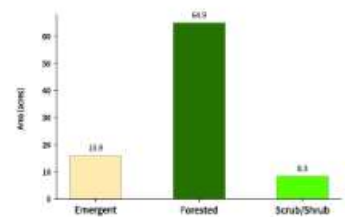
Impervious Surfaces (5.19 acres - 1.9 % of total) (Bottom-Up**)



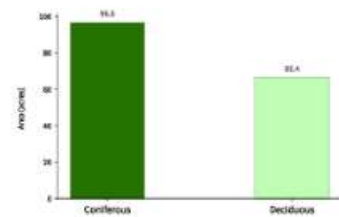
Agriculture (69.13 acres - 24.7 % of total)



Wetlands (89.08 acres - 31.8 % of total)



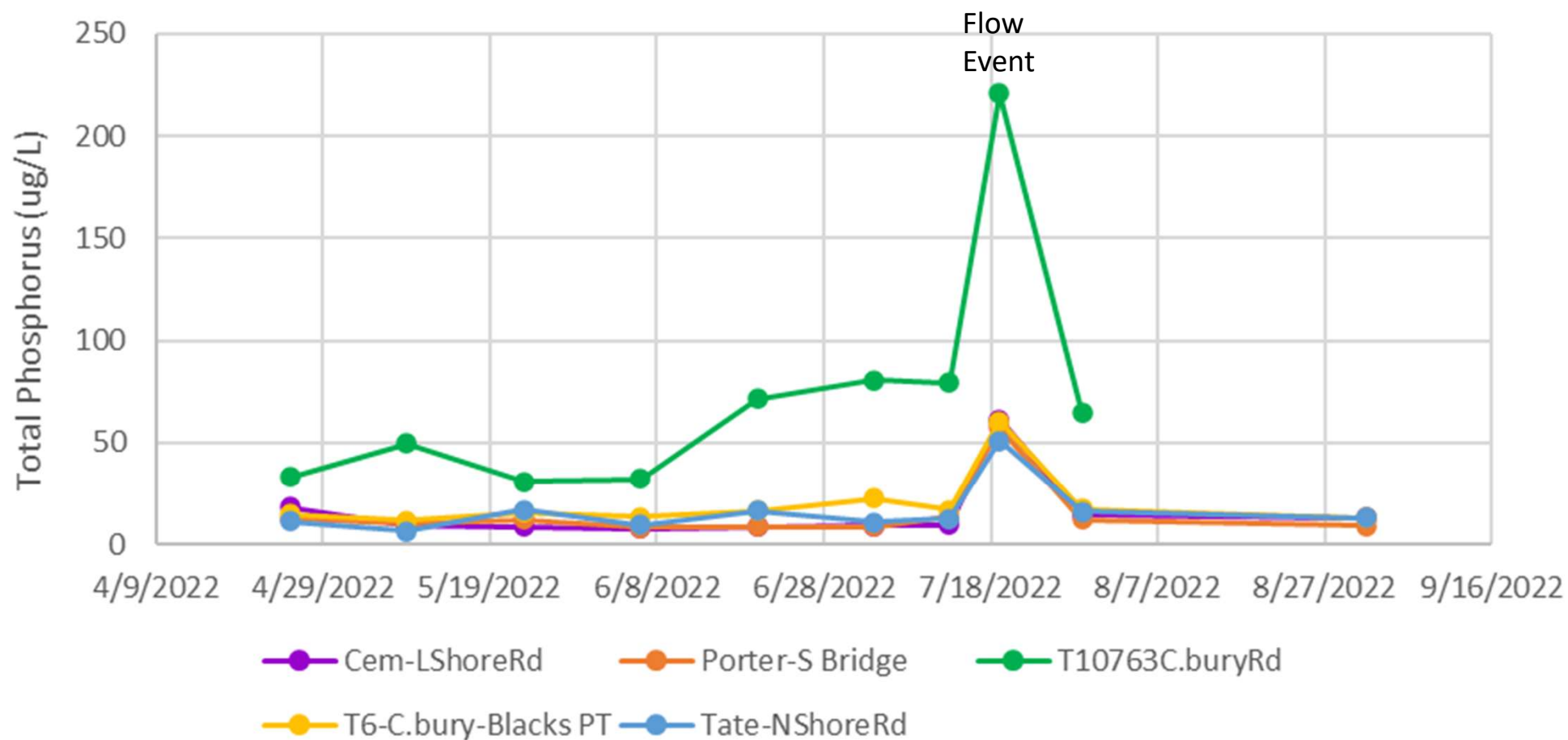
Tree Canopy (162.09 acres - 58.2 % of total)



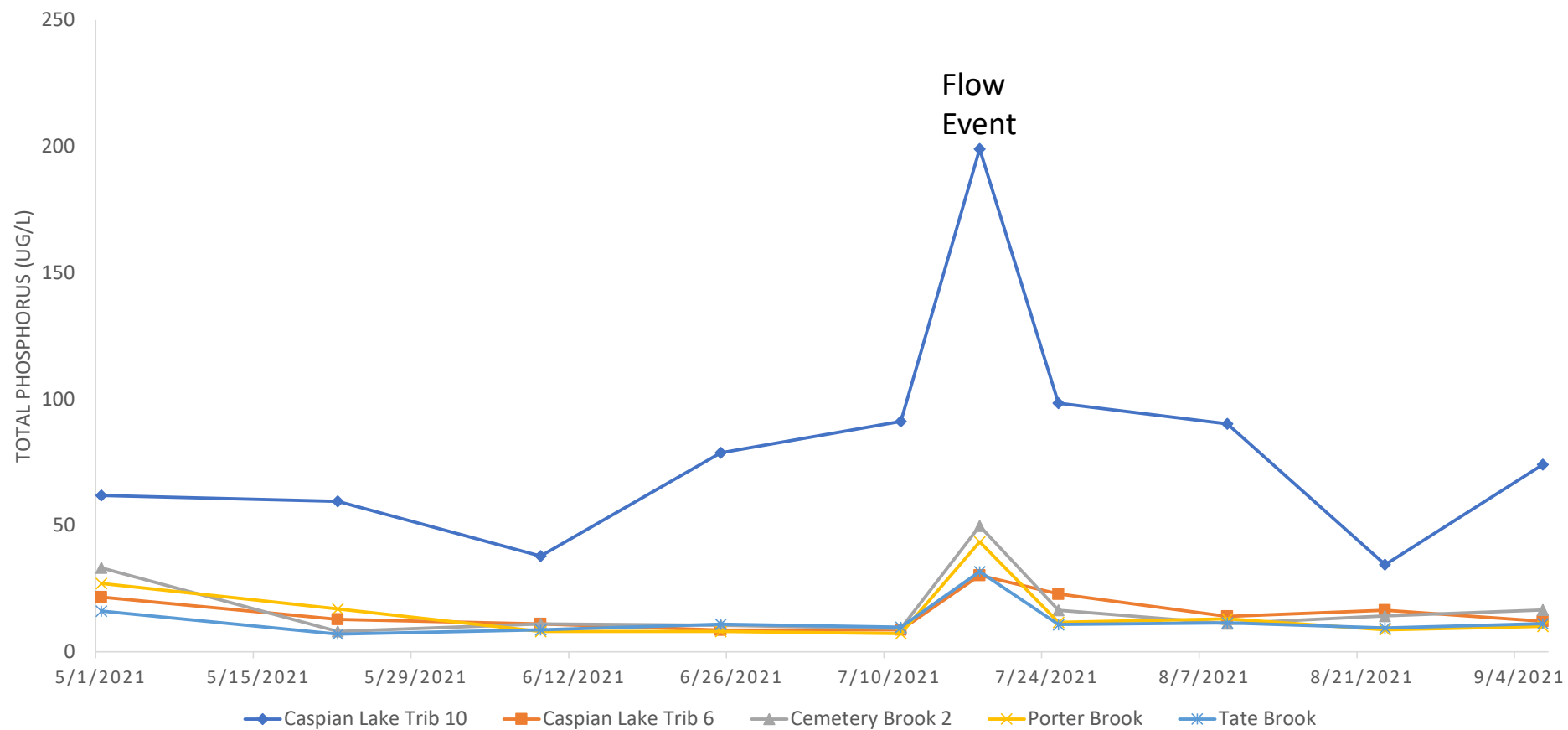
*This report is a preliminary report and is subject to change. The data is based on the most current data available.
 Bottom-Up is a method of land cover mapping that starts with the smallest land cover units and builds up to the larger units. This method is used to ensure that the land cover data is as accurate as possible.



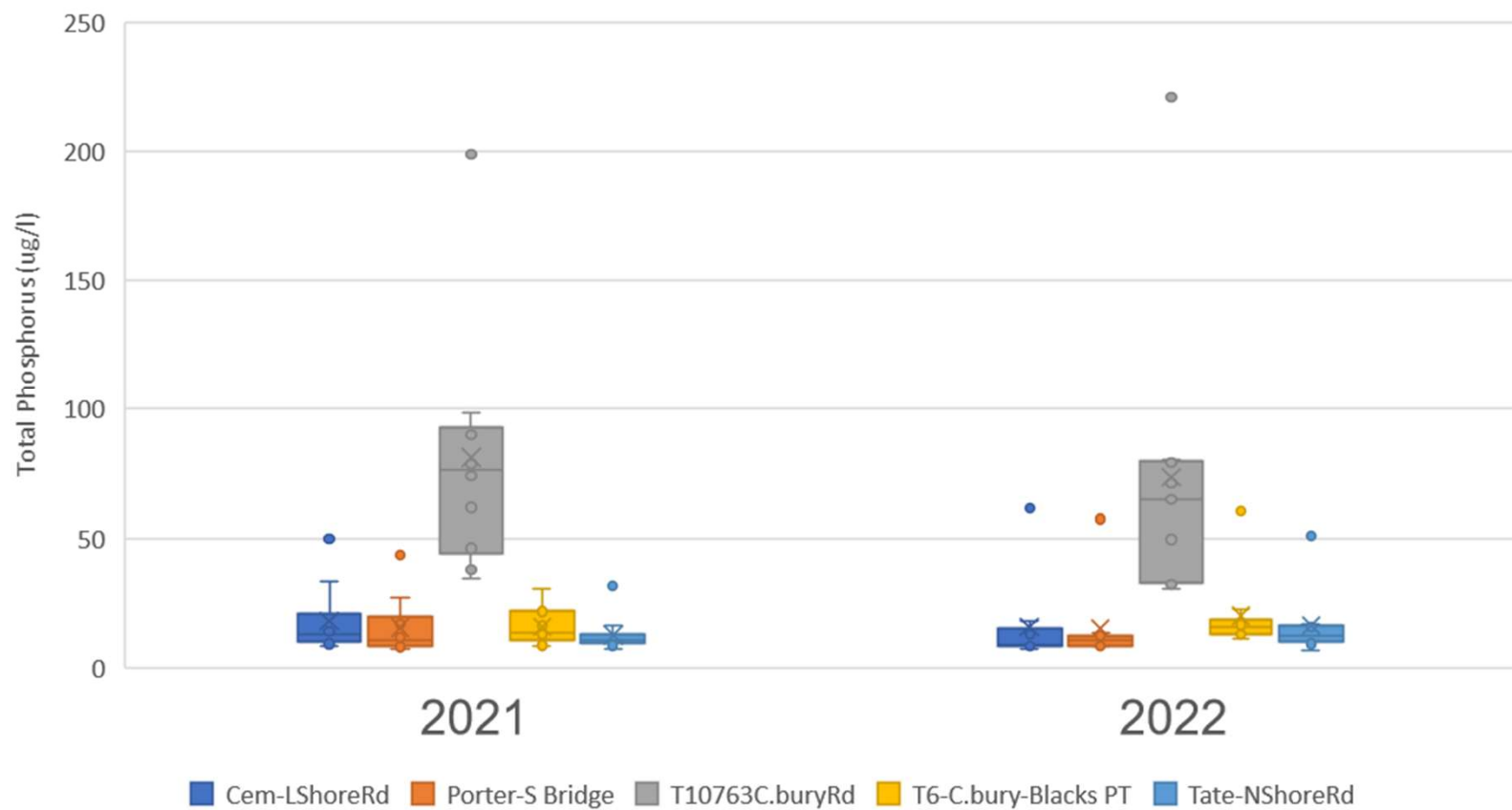
2022 Caspian Lake Tributary Total Phosphorus Monitoring Results



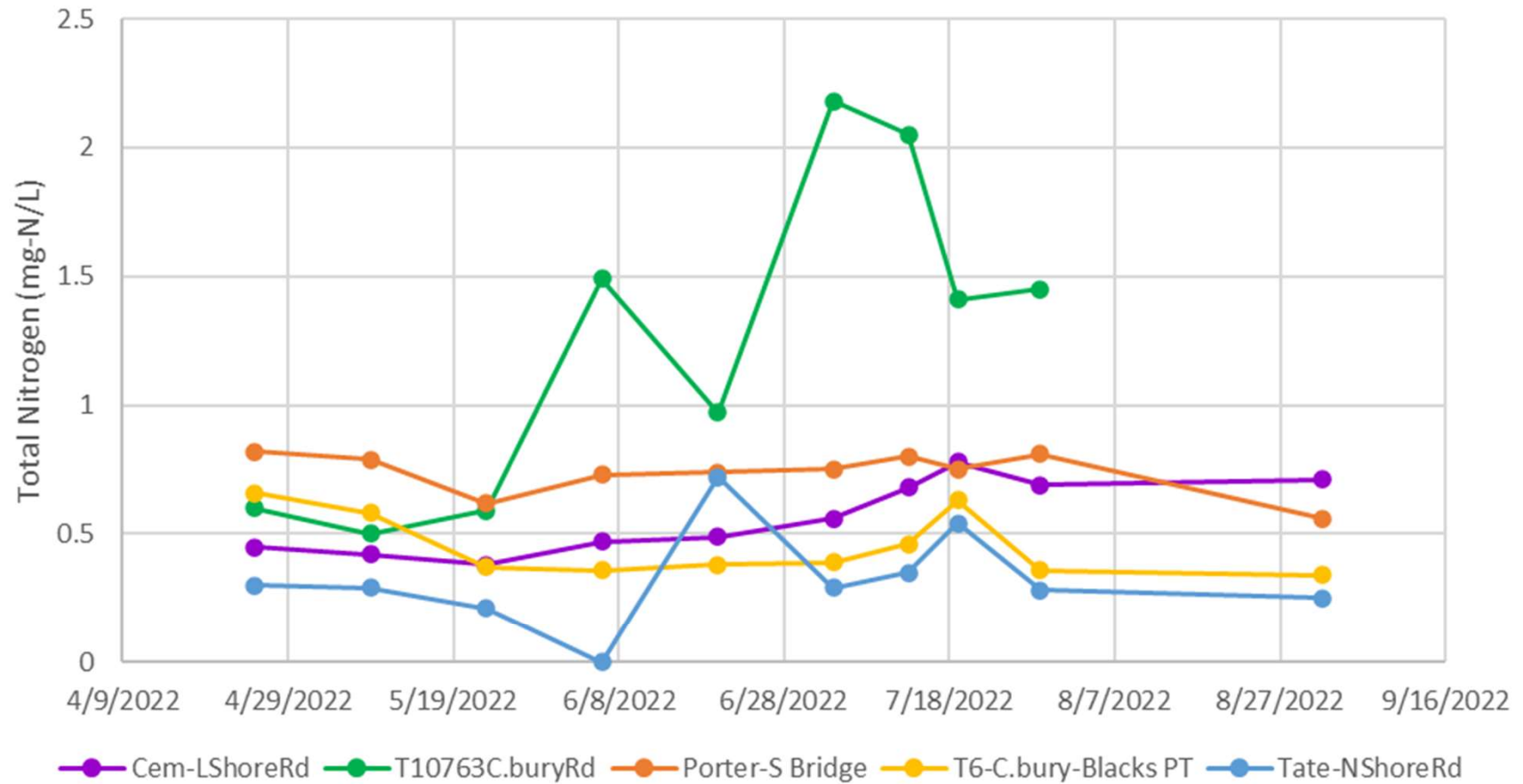
2021 CASPIAN LAKE TRIBUTARY TOTAL PHOSPHORUS MONITORING RESULTS



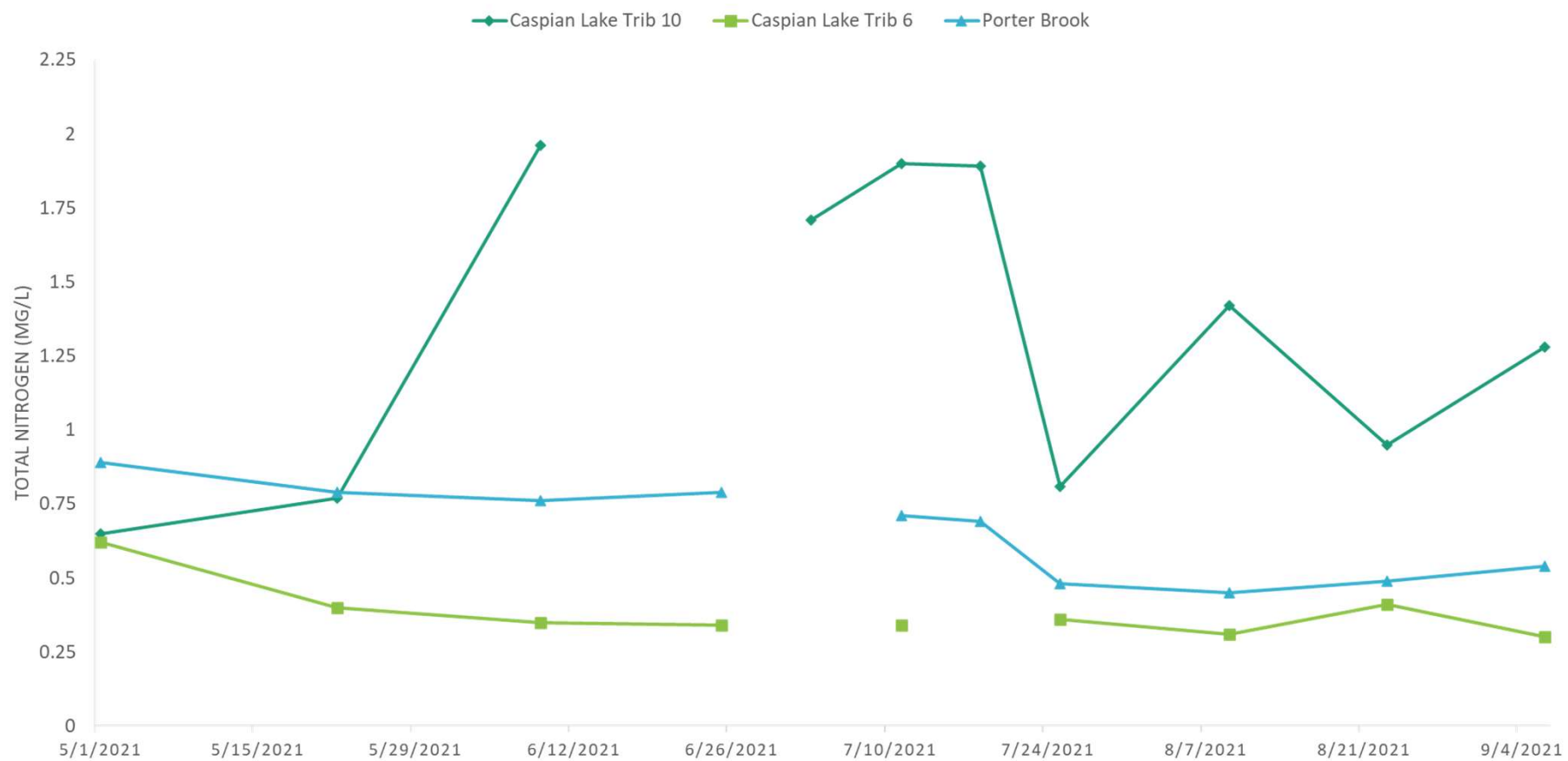
2021-2022 Caspian Lake Tributary Total Phosphorus Comparison



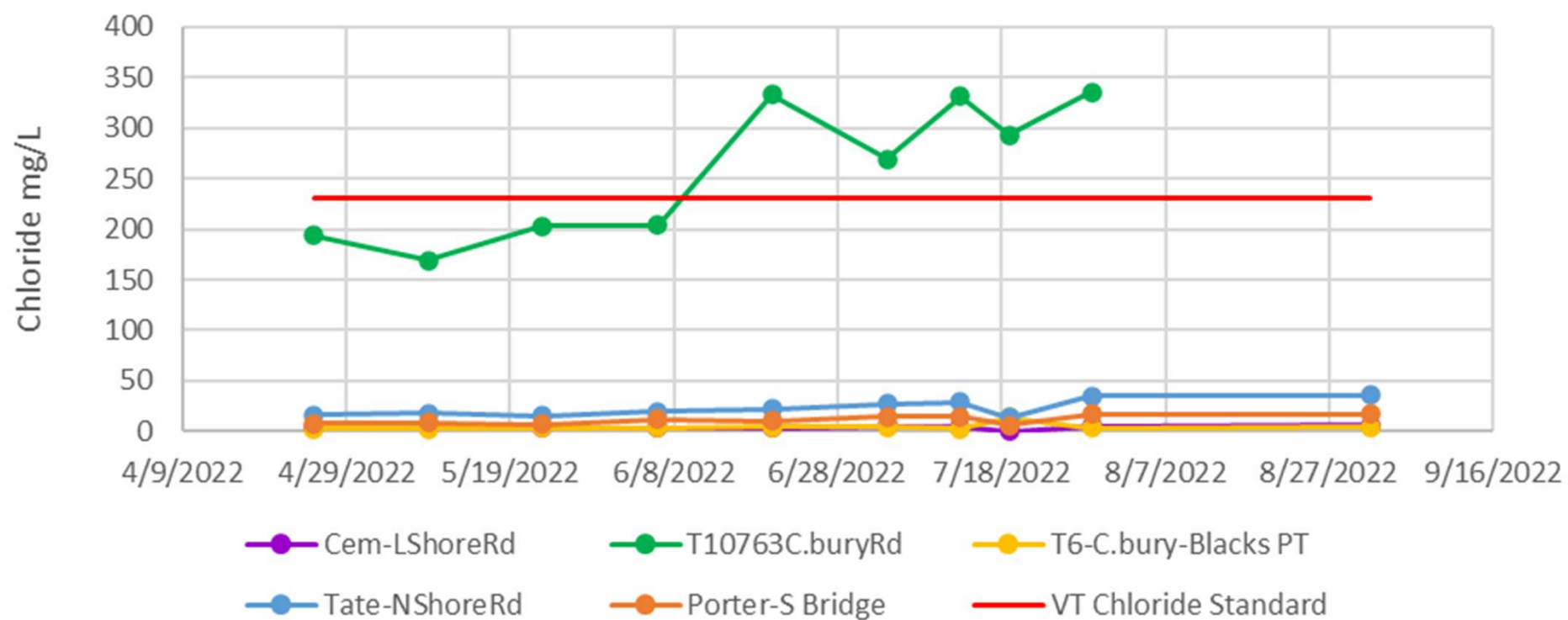
2022 Caspian Lake Tributary Total Nitrogen Monitoring Results



2021 TOTAL NITROGEN

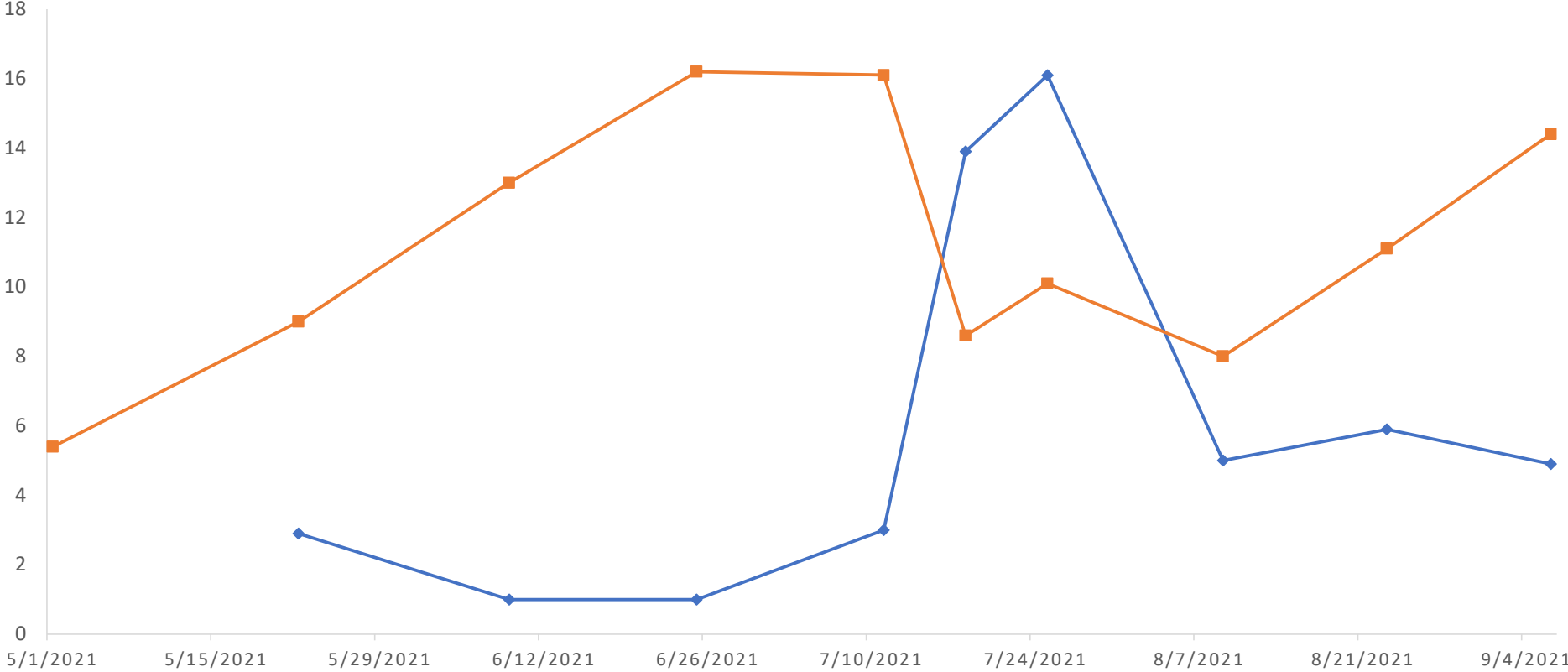


2022 Caspian Lake Tributary Chloride Monitoring Results



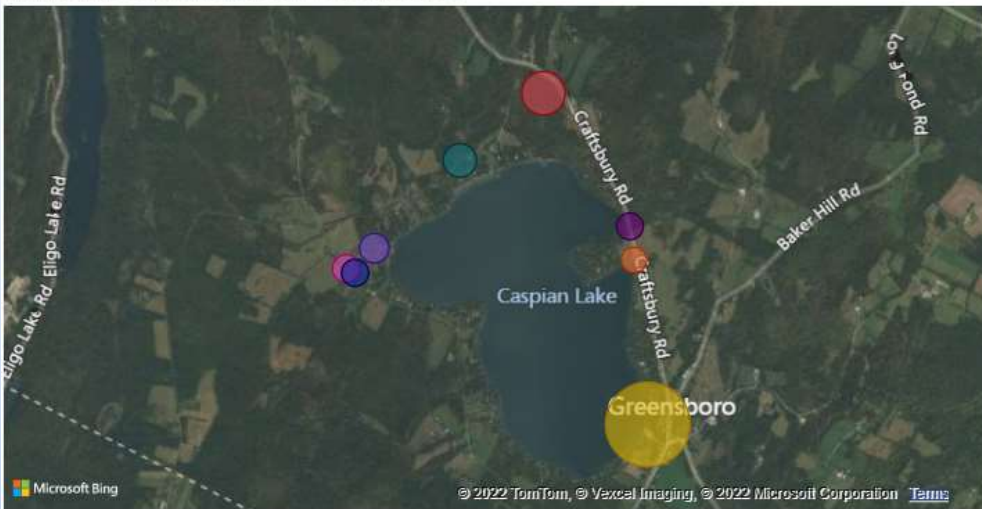
2021 CHLORIDE RESULTS

Caspian Lake Trib 6 Porter Brook



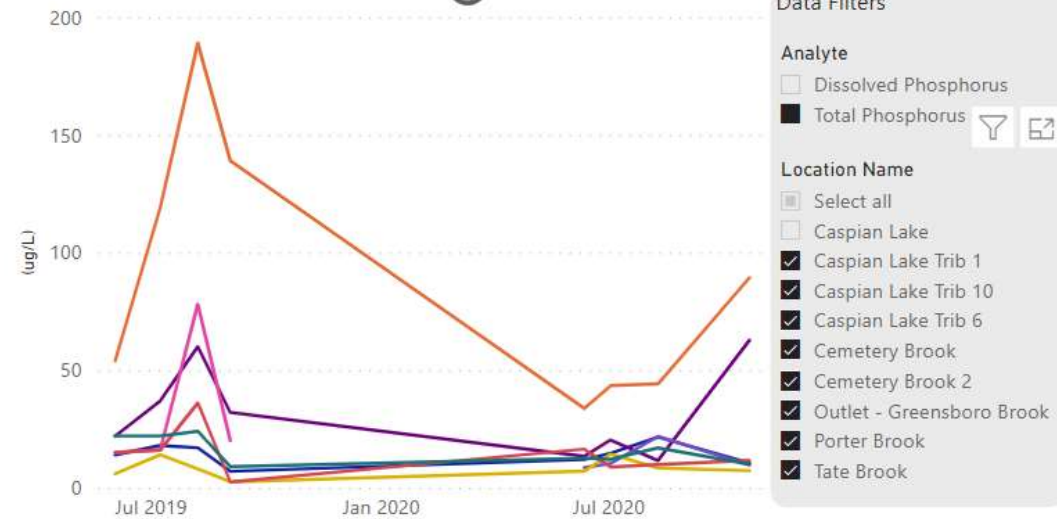
Water Quality Monitoring Results for Lake Caspian and Major Tributaries – 2019 & 2020

Monitoring Locations Sized by Watershed Area

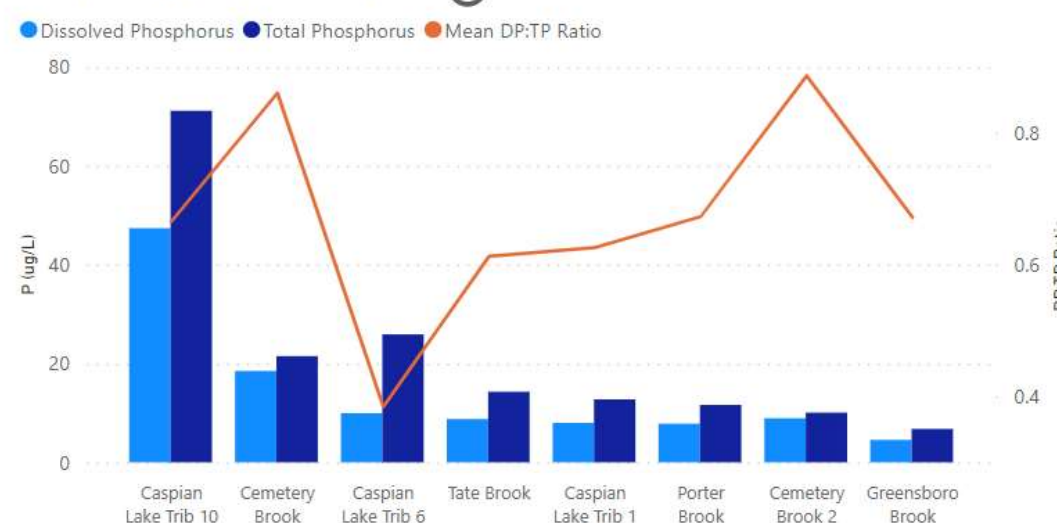


Location Name	Watershed (acres)	% Forest	% Ag	% Developed	% Water/Wetland	% Shrub
Caspian Lake Trib 1	163	81.01	8.61	3.83	6.15	0.41
Caspian Lake Trib 10	30	14.29	62.40	18.05	0.00	5.26
Caspian Lake Trib 6	151	68.38	16.61	10.73	3.53	0.73
Cemetery Brook	176	55.05	37.50	7.45	0.00	0.00
Cemetery Brook 2	339	41.09	40.17	8.19	0.79	9.76
Outlet - Greensboro Brook	4392	54.54	13.07	7.06	22.86	2.48
Porter Brook	1358	75.93	14.96	5.03	1.13	2.95
Tate Brook	622	75.13	2.72	3.72	15.30	3.15

Phosphorus Monitoring Results by Station i



Mean Dissolved P, Total P, and DP:TP Ratio i



2022 Monitoring Summary & 2023 Next Steps

- Lay Monitoring Program (LMP)

- 2022 Summary: Hose samples have higher total phosphorus concentrations than surface samples, but surface samples better reflect Secchi depth for class A1 lake
- 2023 Next Steps: LMP volunteer collects biweekly surface samples and optional deep-water (20 m) samples; LMP staff collects vertical profile data during annual visit; add caffeine testing as human wastewater indicator (i.e. septic systems)

- LaRosa Partnership Program (LPP)

- 2022 Summary: Site 763C.buryRd (Trib 10) has very high TP, TN, and chloride
- 2023 Next Steps: LPP volunteers continue collecting biweekly samples through August at all sites with a focus on 763C.buryRd (Trib 10)

